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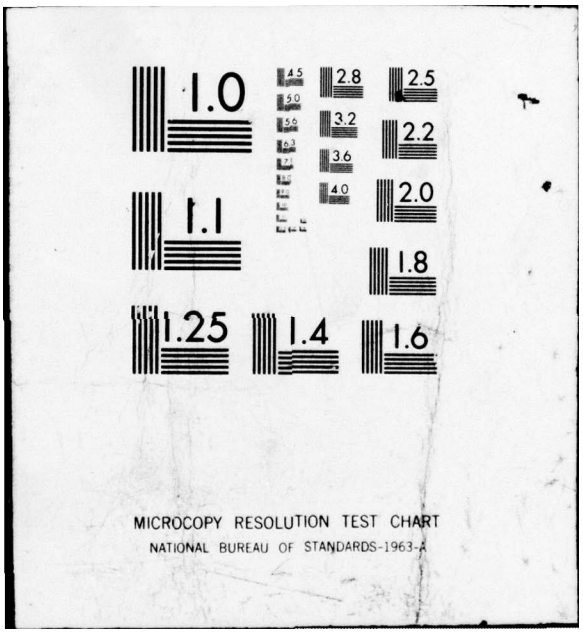
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PTARMIGAN: A UK SECURE AREA-COMMUNICATION SYSTEM FOR ARMED FORCES

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6 AUGUST 1976

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This report summarizes the technical and operational characteristics of the PTARMIGAN system, a UK-developed secure area-communication system for armed forces. It is a computer-based, automatically switched and mobile system that will provide voice, telegraph, data and facsimile modes of operation over a wide geographical area.

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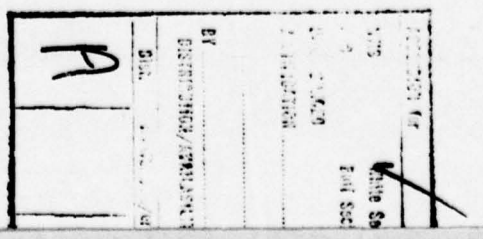
PTARMIGAN: A UK SECURE AREA-COMMUNICATION SYSTEM FOR ARMED FORCES

In 1973 the UK Ministry of Defence (MoD) initiated a project to develop a computer-based, automatically switched, mobile and secure military communication system that will provide voice, telegraph, data and facsimile modes of operation over a wide geographic area. The technical and operational characteristics of the system are to agree with those adopted by the Eurogroup nations, and interfaces with NATO and civil systems are to be provided. The code name assigned to the project was PTARMIGAN, a bird of the grouse family whose plumage changes its color with season. It is a different bird from the mallard which was the code name of an earlier international project on military communications with UK, USA, Canada and Australia as the collaborating nations. However, for some political reason the international consortium was dissolved in 1969 and PROJECT MALLARD died with it. At the recent IEE Conference on Communications Equipment and Systems (COMMUNICATIONS 76) held at Brighton, UK, 8-11 June 1976, technical details about the PTARMIGAN military communication system were revealed to the public for the first time. I will try to summarize here some of the essential features of the system which is currently under intensive development and is expected to see field deployment in the early 1980's.

PTARMIGAN consists of a trunk network which provides flexible and survivable digital communications over a tactical area of responsibility. This lattice of trunk nodes (communication centers) is connected by secure multichannel radio links. The trunk nodes are mobile with short set-up and tear-down times so that the system can respond rapidly to requests for tactical movements or deployment. A mesh configuration is used to give the redundancy necessary to ensure continued reliable operation even when a substantial proportion of the system has been damaged or destroyed. Large HQs are served by an access node which includes a trunk switch connected to the network by two radio-relay links to different trunk nodes. Individual and small groups of personnel close to a switch are connected by single or multiquad cables. Larger groups further away are connected by multiplexing the individual channels over a single HF quad, and, if necessary, by SHF or UHF radio relay depending on distance and terrain.

Isolated users (either static or mobile) are given full trunk-system service via a single-channel radio-access (SCRA) subsystem. The SCRA subsystem consists of two types of installations operating in the VHF band: the mobile subscriber's terminal and a "central." Each "central" may be shared by up to 25 mobile subscribers which can be from 15 to 30 km away from the "central." Automatic transmitter-power control is used at the mobile terminals in order to reduce the problems of a wide variation in the signal level reaching the "central" receiver. The modulation system chosen is four-level differential phase-exchange keying



(DPEK) because of its excellent adjacent-channel-rejection property. Channel spacing is standardized to multiples of 12.5 kHz.

Subscribers communicate in any one of four modes (voice, telegraph, facsimile, or data) at one of three precedence levels (Flash, Priority, or Routine). The basic channel rate for all modes is 16-kb/s and analog-to-digital conversion takes place at the subscriber's terminal by delta modulation. The 16-kb/s channels are time-division-multiplexed (TDM) into 16 or 32 channel groups. The network timing is plesiochronous with each switch automatically timed from its own rubidium frequency standard which has a long-term stability of better than one part in 10^9.

The radio links in PTARMIGAN are cryptographically protected. Each subscriber is identified by a unique seven-digit directory number which is deducible only from his military appointment. When a called subscriber is not attached to the same node as the calling subscriber and his location is not known, a flood message is sent out. Each node keeps an updated record of preferred and alternative paths to every other node. From this record and taking into account the current traffic demands, the originating node computes and selects the preferred link. Written-message traffic may either be direct from subscriber to subscriber or through a store-and-forward (S&F) installation which holds and processes messages before delivering them in order of precedence. A number of S&F installations are connected into the network at any one time, each receiving messages from subscribers in its own service area and transmitting them directly to the address anywhere in the network.

Management and control of the PTARMIGAN system is designed to cope with frequent network configuration changes and possible damages to system facilities. A hierarchical structure consisting of three levels is used. The first level is the system executive and planning control which carries out long-term planning and issues executive instructions. The second level is the operational system control where the technical management carries out the executive instructions. The third level is the facilities control where the detailed engineering of links and installations takes place. A computer-based information storage-and-retrieval system and the required management software for computer-to-computer communication and man-machine interface are provided. PTARMIGAN permits direct interface with other communication systems built to Eurocom standards. (Eurocom is one of the activities of the Eurogroup nations concerned with the standardization of characteristics for tactical military communication systems.) Where conversion is required between PTARMIGAN and other systems, a separate interface installation will be connected to an appropriate node.

The PTARMIGAN military communication system represents a major UK developmental effort. It claims to meet the military requirements of security, survivability, mobility, flexibility, and maintainability.

The Plessey Company is the Prime Contractor having a direct responsibility to the MoD for managing the entire project. Production contracts starting in 1980 are expected to exceed £100 million, and a conscious effort was made at COMMUNICATIONS 76 to sell the system also to other countries. The Plessey people acknoweldged that three similar systems are under development outside of the UK; namely, the TRITAC System in US, the RITA System in France and the AUTOKO System in West Germany, but they hastened to emphasize that all these systems are being developed to national requirements and "do not fully meet the agreed parameters drawn up by the Eurogroup nations." It will be necessary for these countries to present convincing counter-arguments on tactical, technical or economic grounds in order to win contracts from other countries. It was disclosed that a number of foreign delegations attended COMMUNICATIONS 76. The early disclosure of PTARMIGAN's technical capabilities coupled with Plessey's sales pitch appears to give the UK system an initial edge. Readers desiring more information can refer to the following articles in *IEE Conference Publication No. 139 on Communications Equipment and Systems (1976)*:

1. J. L. Akass and N. C. Porter, "The Ptarmigan system," p. 252.

2. H. V. Bell and P.K.C. Maher, "Operation control of Ptarmigan communication system," p. 272.

3. T. J. Hewson and P. Robinson," A separate channel signalling system for tactical telecommunications," p. 301.

4. R. Thompson, "The design of VHF radio equipment for the Ptarmigan SCRA subsystem," p. 308.

5. A. F. Evers, "Single channel radio access (SCRA) - The UK user requirement and sub-system solution," p. 312.

6. F. B. Johnson, "The use of computer modelling in Project Ptarmigan," p. 320.